

Nitrate in Drinking Water

Nitrate is a compound that occurs naturally and also has many human-made sources. Nitrate is in some lakes, rivers, and groundwater in Minnesota. You cannot taste, smell, or see nitrate in water. Consuming too much nitrate can be harmful—especially for babies.

Health Effects

Consuming too much nitrate can affect how blood carries oxygen and can cause methemoglobinemia (also known as blue baby syndrome). Bottle-fed babies under six months old are at the highest risk of getting methemoglobinemia. This illness can cause skin to turn a bluish color and can result in serious illness or death. Other symptoms connected to methemoglobinemia include decreased blood pressure, increased heart rate, headaches, stomach cramps, and vomiting.¹ The following conditions may also put people at higher risk of developing nitrate-induced methemoglobinemia: anemia, cardiovascular disease, sepsis, glucose-6-phosphate-dehydrogenase deficiency, and other metabolic problems.²

Recently, scientific evidence has emerged to assess the health impacts of drinking water with high nitrate on adults. A growing body of literature indicates potential associations between nitrate/nitrite exposure and other health effects such as increased heart rate, nausea, headaches, and abdominal cramps. Some studies also suggest an increased risk of cancer, especially gastric cancer, associated with dietary nitrate/nitrite exposure, but there is not yet scientific consensus on this question.

How to Protect Yourself and Your Family

The U.S. Environmental Protection Agency (EPA) standard for nitrate in drinking water is 10 milligrams of nitrate (measured as nitrogen) per liter of drinking water (mg/L).^{*} Drinking water with levels of nitrate at or below 10 mg/L is considered safe for everyone.

^{*}1 milligram per liter (mg/L) is roughly the same as 1 part per million

If you have a private well

The following types of wells are the most vulnerable to nitrate contamination, especially if they are near septic tanks or areas with agricultural activities:

- Shallow wells.
- Wells in sand aquifers.
- Dug wells with casings that are not watertight.
- Wells with damaged or leaking casings or fittings.

Prevent Contamination

- **Construct your well in a safe spot.** See the *Protecting Your Well* webpage for guidance.
- **Keep nitrate sources away from your well.** Sources may include fertilizer, septic systems, and animal waste. See *Protecting Your Well* for tips.
- **Regularly inspect your well for damage** (see *Protecting Your Well*). Contact a licensed well contractor if you find any damage (see *Licensed Well and Boring Contractor Directory*).
- **Test for nitrate every other year.** You are responsible for regularly testing your well water. Minnesota Department of Health (MDH) recommends using an accredited laboratory to test your well water (see *Search for Accredited Labs*). Contact the laboratory to get sample containers and instructions, or ask your county environmental or public health services if they provide well water testing services.

Address Contamination

If nitrate is detected in your well water, there may be other contaminants in the water as well. If nitrate is detected in your water at levels above 10 mg/L, follow these steps:

- **Get your drinking water from a safe source**, such as bottled water. This is especially important if babies under six months old drink the water or formula made with the water. Boiled water is not

¹ Agency for Toxic Substances and Disease Registry (ATSDR). 2015. *ToxFAQs™ for Nitrate and Nitrite* (<http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=1186&tid=258>). Accessed October 2016.

² ATSDR. 2013. *ATSDR Case Studies in Environmental Medicine Nitrate/Nitrite Toxicity* (http://www.atsdr.cdc.gov/csem/nitrate_2013/docs/nitrite.pdf). Page 37. Accessed October 2016.

a safe alternative; boiling water will make nitrate more concentrated.

- **Have a licensed well contractor inspect your well.**
- **Find and remove potential sources of nitrate** contamination on your property (see *Protecting Your Well* webpage for sources to check).
- **Home water treatment may be an option** if you have taken steps to reduce or eliminate all potential sources of nitrate, a licensed well contractor inspected your well and determined it is working properly, and no babies under six months old drink the water.

If you are on a public water system

Your public water system regularly tests for nitrate and makes sure levels meet the EPA standard. You can find the level of nitrate detected in the system serving where you live by reading the system's water quality report (also known as a Consumer Confidence Report [CCR]). Call your water system to get a paper copy of your CCR, or find it online (see *Consumer Confidence Report*). If you want to find the level of nitrate for a place besides your home, contact the water system serving that location.

Background Information

Nitrate occurs naturally and at safe and healthy levels in some foods (e.g., spinach and carrots) and comes from natural processes, such as plant decay. Nitrate is in many fertilizers used on yards, golf courses, and crops. Other sources of nitrate include discharge from sewage systems and animal wastes.

Natural processes can cause low levels of nitrate in drinking water—usually less than 3 mg/L. The health concern is with levels of nitrate over 10 mg/L. High levels of nitrate in water can be from runoff or leakage from fertilized soil, wastewater, landfills, animal feedlots, septic systems, or urban drainage.

Nitrate in Minnesota Water

Nitrate has been detected in groundwater and surface water in many places in Minnesota. Land use and hydrogeology affect the levels of nitrate in water.

About 4 percent of private wells constructed in Minnesota since 1991 have nitrate levels above 3 mg/L. While 3 mg/L is less than the EPA standard, it suggests human-made sources of nitrate have contaminated the water and the level could increase over time. Minnesota Department of Agriculture Township Testing Program found that over 10 percent of the private wells sampled in some

townships in southwestern, southeastern, central, and north-central Minnesota have nitrate levels above 10 mg/L.

Minnesota Pollution Control Agency found that 27 percent of surface water samples had nitrate levels above 10 mg/L. Southern Minnesota had the highest levels of nitrate in surface water (see *Report on Nitrogen in Surface Water*).

Over the past 20 years, a few public water systems in Minnesota have detected nitrate levels above 10 mg/L in treated water; they have worked to address the issue. See *Nitrate in community water systems: facts and figures* and *MDH Drinking Water Protection Annual Reports* for more information.

Resources

- [Consumer Confidence Reports](http://www.health.state.mn.us/ccr) (www.health.state.mn.us/ccr)
- [Drinking Water Protection Annual Reports](http://www.health.state.mn.us/communities/environment/water/dwar) (www.health.state.mn.us/communities/environment/water/dwar)
- [Home Water Treatment](http://www.health.state.mn.us/communities/environment/water/factsheet/hometreatment) (www.health.state.mn.us/communities/environment/water/factsheet/hometreatment)
- [Licensed Well and Boring Contractor Directory](http://www.health.state.mn.us/lwcsearch) (www.health.state.mn.us/lwcsearch)
- [Nitrate in community water systems](https://apps.health.state.mn.us/rmndata/nitrate-messaging) (apps.health.state.mn.us/rmndata/nitrate-messaging)
- [Nitrate in Well Water \(PDF\)](http://www.health.state.mn.us/communities/environment/water/docs/wells/waterquality/nitrate.pdf) (www.health.state.mn.us/communities/environment/water/docs/wells/waterquality/nitrate.pdf)
- [Protecting Your Well](http://www.health.state.mn.us/communities/environment/water/wells/construction/protect) (www.health.state.mn.us/communities/environment/water/wells/construction/protect)
- [Report on Nitrogen in Surface Water](http://www.pca.state.mn.us/featured/report-nitrogen-surface-water) (www.pca.state.mn.us/featured/report-nitrogen-surface-water)
- [Subsurface Sewage Treatment Systems](http://www.pca.state.mn.us/water/subsurface-sewage-treatment-systems) (www.pca.state.mn.us/water/subsurface-sewage-treatment-systems)
- [Township Testing Program](http://www.mda.state.mn.us/townshiptesting) (www.mda.state.mn.us/townshiptesting)

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08/06/2019R

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